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Inventor: Sines
Serial No. 09/364,256

PATENT APPLICATION
Navy Case No. 79,955

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: E. Sines

Serial No. 09/364,256 Examiner: G. Perez

Filed: July 30, 1999 Group Art Unit: 2834

For: ELECTRICAL POWER
COOLING TECHNIQUE

AMENDMENT

Commissioner of Patents and Trademarks
Washington, DC 20231

Sir:

In response to the Examiner's Office Action dated January 5, 2000, it is respectfully requested that the following amendment in the above-identified application be entered into the record.

IN THE SPECIFICATION:

Page 1, Line 5: Insert the following sentence:

--This ~~His~~ application is a Divisional Application of the application having the Serial No. 08/940,179.

IN THE CLAIMS:

13.(Twice Amended) An electric motor [comprised of] comprising:

one or more laminations of a metallic material forming [the] an outer casing if the electric motor;

one or more circular thermally conductive disks placed

between preselected layers of the motor laminations, said conductive disks conducting heat[,] generated by an electrical current flowing within the motor[,] to an edge of the conductive disk outside of the area covered by the motor laminations;

an electrically conductive material wound in a plurality of layers within the laminations so as to form an electric field that drives an armature when an electrical current is applied;

thermally conductive strips placed between preselected layers of the electrically conductive material, said thermally conductive strip extending outside of the area covered by the electrically conductive material; and

means for conducting heat at the end of the conductive disk and strips.

15. (Twice Amended) A method, as in Claim 14, further comprising the steps of:

placing a thermally conductive strip having a first [ad] <u>and</u> second end between predetermined laminations of the core, said first and second ends of the thermally conductive [material] <u>strip</u> extending outside of the core.

16. (Amended) A method for cooling an electrical device having layers of electrically conductive material wound on to a

laminated core having a heat generating component comprising the steps of:

placing one or more thermally conductive strips in contact with the heat generating component, said thermally conductive strip extending outside of the area covered by the electrically conductive material and core and in physical with the electrically conductive material, thereby receiving heat from the heat generating component; and

removing heat from the thermally conductive strips.

26. (Amended) An electric motor, as in Claim 13, further [comprised of] comprising one or more thermocoolers adjacent to [ad] and touching the outer casing of the motor to conduct heat from the metallic laminations forming the outer casing of the motor.

REMARKS

Claims 13 - 16 and 26 are pending in this application.

Claims 13-16 and 26 have been rejected by the Examiner.

OBJECTION BY THE EXAMINER:

The Examiner has objected to Claims 15 and 26 because of the word "ad" appearing at line 2 in Claims 15 and 26.

In Claims 15 and 26, te word "ad" has been amended to read

properly --and--.

It is respectfully submitted that this amendment removes the Examiner's objection to Claims 15 and 26.

REJECTION UNDER 35 USC § 112 SECOND PARAGRAPH

The Examiner has rejected Claims 13 and 26 under 35 USC § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Specifically, the Examiner states that Claim 13 contains no antecedent basis for the term "the outer casing".

Claim 13 has been amended to delete the word "the" on line 2 of the claim and insert the word --an--.

It is respectively submitted that Claims 13 and 26 are now allowable, Claim 26 being a dependent claim of independent Claim 13 and placing further limitations on Claim 13 is allowable if the independent Claim 13 is allowable.

REJECTION UNDER 35 USC § 102(b):

The Examiner has rejected Claim 16 under 35 USC § 102(b) as being anticipated by *Jarczynski* (US Patent 5,091,666).

Specifically, the Examiner states that *Jarczynski* "discloses a method for cooling an electrical device having layers of electrically conductive material wound on to a laminated core

having a heat generating component comprising the steps of placing one or more thermally conductive strips in contact with the heat generating component, said thermally conductive strips receiving heat from the heat generating component; and removing heat from the thermally conductive strips.

" Claim 16 reads as follows:

> 16. (Amended) A method for cooling an electrical device having layers of electrically conductive material wound on to a laminated core having a heat generating component comprising the steps of:
>
> placing one or more thermally conductive strips in contact with the heat generating component, said thermally conductive strip extending outside of the area covered by the electrically conductive material and core and in physical with the electrically conductive material, thereby receiving heat from the heat generating component; and
>
> removing heat from the thermally conductive strips.

Jarczynski teaches an electrical power generating system having a thermal collector sleeved to an electromagnetic stator core with a number of coolant fluid passages that allows a collant fluid (preferably water) to circulate within the passages and thereby remove heat conducted to the thermal collector. The composite core of the device is composed of a number of core laminations with thermally conductive laminations (e.g., aluminum or copper) interposed between preselected adjacent pairs of core laminations. Even though the thermally conductive laminations made of copper are in close proximity to the motor windings, they

DO NOT go into the motor coil bundle or windings.

The thermally conductive material taught by *Jarczynski* do not extend outside of the heat generating component., Further, the heat generated by *Jarczynski* is removed by the use of a specifically enumerated manner, circulated water. The critical difference between *Jarczynski* and Applicant's claimed invention is that the thermally conductive material (in this case K1100) thermal interface provides a direct path from the interior of the motor windings directly to the outer case of the electrical device so as to cool the windings directly and minimize the mitigation of heat into the laminations of the electrical device while at the same time increasing the current density of the electrical device, thereby increasing the power density of the electrical device. **SEE**, Declaration of Dr. William Howell submitted in the parent case Serial No. 08/940,179.

Jarczynski is a system for cooling a motor stator assembly for electrical machinery. *Jarczynski* provides for [preferred thermal paths through motor laminations to provide better heat conduction for the heat generated in the motor to dissipate. The preferred thermal paths are said to be constructed of a number of thermally conducting laminations interposed between preferred ones of the core laminations that form the electromagnetic core. These thermally conducting laminations are preferably thin metal copper sheets placed between the iron laminations of the motor,

directing heat to the liquid coolant pumped through the outside casing of the motor. The liquid coolant then passes through a radiator to dissipate the heat and thereby cool the motor laminations. *Jarczynski* does not teach the entering of the windings, only the laminations of the motor, nor does *Jarczynski* teach extending the thermally conducting laminations outside of the core or electrical windings of the core. In *Jarczynski* the heat in the motor electrical windings does not leave the interior of the windings.

The critical difference between *Jarczynski* and the Appliocan's claimed invention is that the thermaly conductive material (in this case K1100) thermal interface provides a direct path from the interior of the motor windings and laminations directly to the outer case of the electrivcal device so as to cool the internal windings and case directly and minimize the migration of heat while at the same time increasing the current density of the electrical device, thereby increasing the power density of the electrical device. **SEE**, Declaration of Dr. william Howell in the parent case Serial No. 08/940,179 (currently allowed)).

Therefore, it is respectfully submitted that Claim 16 is now allowable because *Jarczynski* does not teach each and every element of the Applicant's claimed device specifically that the thermally conductive strips go within the layers of electrically

conductive material (the windings and laminations), as well as the core of any device.

REJECTION UNDER 35 USC § 103(a)

The Examiner has rejected Claims 13-15 and 26 under 35 USC § 103(a) as being unpatentable over *Jarczynski* in view of *Davis* (US Patent No. 5,949,170).

The Examiner states that *Jarczynski* does not: (1) disclose thermally conductive strips placed between preselected layers of electrically conductive material, said thermally conductive strip extending outside of the area covered by the electrically conductive material, nor (2) that the method of cooling comprises the step of placing a thermally conductive material , having a first and second end, capable of conducting heat from between preselected layer of the electrically conductive material said first and second end of the thermally conductive material; and conducting the heat from the first and second ends of the thermally conductive material.

Davis, on the other hand, teaches (1) a thermally conductive strips placed between preselected layers of the electrically conductive material, so the Examiner states, and said thermally conductive strip extending outside of the area covered by the electrically conductive material, and (2) the method of cooling comprises the step of placing a thermally conductive material, aving a first and second end, capable of conducting from between

preselected layer of the electrically conductive material said first and second end of the thermally conductive material extending outside of the area covered by the electrically conducting material; and conducting the heat from the first and second ends of the thermally conductive material for the purpose of dissipating the heat created in the windings.

The Examiner opines that it would have been obvious t modify the electric motor of *Jarczynski* and provide it with thermally conductive strips placed between preselected layers of the electrically conductive material as disclosed by *Davis* for the purpose of cooling.

The foregoing discussion of *Jarczynski* is hereby incorporated in this argument in total.

Davis teaches the placing of additional insulation in the form of wrapped sheets or insulating sleeves for the outermost winding turns of the phase windings of a switched reluctance machine, the additional insulation enables the outermost winding turns to better handle the voltage stresses resulting from the high frequency voltage pulses associated with the machine windings. In another embodiment, *Davis* teaches a sheet of insulation material positioned between the outermost layer of the winding turns and the next adjacent layer. (Col. 2, Lines 50-60)

Davis teaches several methods for reducing voltage stress induced failures in switched reluctance motors. In the first,

additional insulating material, such as that commonly found in electrical motors, is provided around the last few turns of the winding. (Col. 6, Lines 66-67, and Col. 7. Lines 1-3) In another method, a sheet of insulating material is provided between the outermost layer and the immediately inwardly adjacent layer (Col. 7, Lines 12-14), and it is not essential that the sheet of insulating material extend across the entire span of the outermost layer as long as it extends under the last few turns of the winding. (Col. 7, Lines 17-19) In yet another embodiment, a conductive layer is used to distribute capacitively the transient voltage spikes that occur over the last few winding turns. (Col. 7, Lines 28- 29) Continuing, another embodiment places a layer of conductive material sandwiched between two layers of insulating material placed between the outermost layer and next to the inwardly adjacent layer. Col. 7, Lines 35-39)

In all the cited embodiments of *Davis*, the purpose of the conducting layer and insulating material is to form a capacitive voltage distribution that distributes the voltage stresses that are placed on the lat few winding turns when a high frequency or high dV/dt voltage pulse is applied to the motor.

Therefore, it is respectfully submitted, *Davis* DOES NOT teach the removal of heat from the inner windings of a motor or any other electrical device, as claimed by the Applicant in Claims 13-15 and 26.

The teaching of *Jarczynski* do not individually or collectively suggest or imply that the teaching of *Davis* should or could be applied to define the invention claimed by the Applicant in Claims 13-15 and 26. On the contrary, Applicants claimed device is for the cooling of the interior of an electrical device or motor by bringing the heat to the outside of the motor casing by thermal conductivity where the heat can be dissipated, whereas a device incorporating *Davis* teachings is to form a capacitive element (insulating layer and conductive layer) to assure that the voltage stresses concentrated in the outermost turns are distributed and shared by other turns in the coil. (Col 7, Lines 56-66)

Therefore, it is respectfully submitted that the Examiner's basis of rejection under 35 USC § 103(a) has been overcome because *Jarczynski* individually or in combination with *Davis* does not teach or suggested the claimed invention of the Applicant as shown in Claims 12-15 and 26.

CONCLUSION

In view of the foregoing discussions, it is respectfully submitted that all of the grounds for rejection of Claims 13- 16 and 26 have been overcome and that these claims are now allowable. It is therefore respectfully requested that Claims 13-16 and 26 be allowed and that this application be passed to

issue with such allowed claims, an early action to that effect is courteously solicited.

Respectfully submitted,

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